

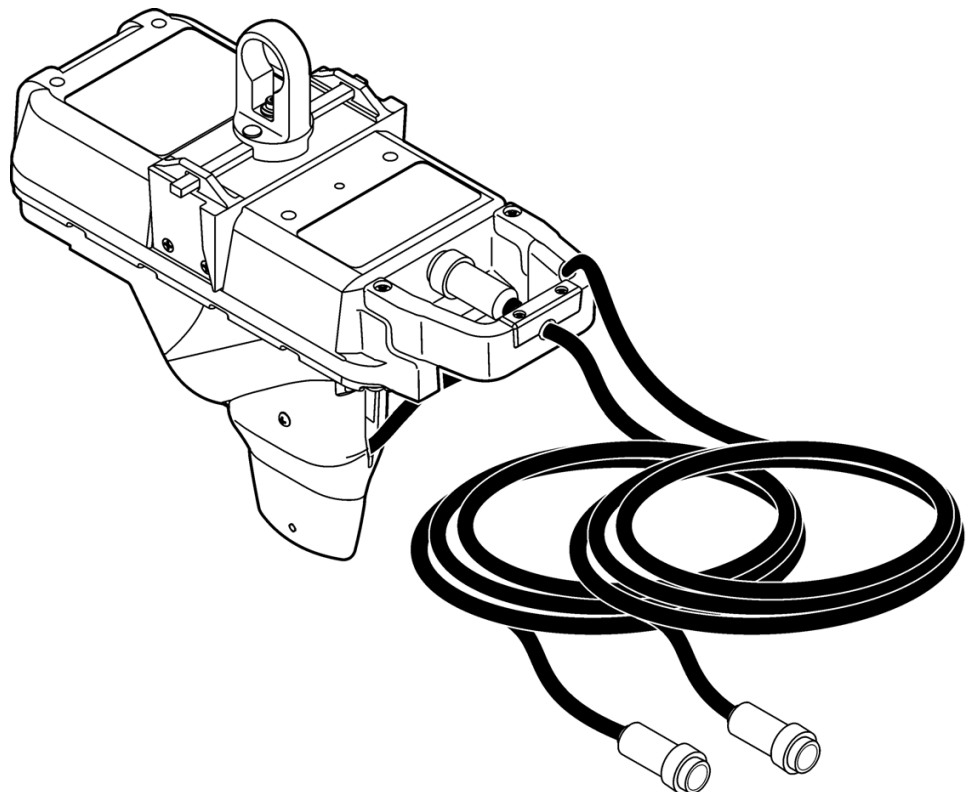
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Flo-Dar™ Intrinsically Safe Sensor

Open Channel Non-Contact Radar Sensor
with Optional Surcharge Velocity Sensor

USER MANUAL

June 2010, Edition 1



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Section 1 Specifications

Specifications are subject to change without notice.

General	
Certification	cETLus Listed, ATEX EC-Type Certified Flo-Dar:  II2G, Ex ib IIB T4 Gb, ITS10ATEX27065X, and Class I, Zone 1 AEx ib IIB T4 Gb and Class I, Zone 1 Ex ib IIB T4 Gb Barrier:  II(2)G, [Ex ib Gb] IIB, ITS10ATEX27042X, and Class I, Zone 1 [AEx ib Gb] IIB and Class I, Zone 1 [Ex ib Gb] IIB SVS:  II2G, Ex ib IIB T4 Gb, ITS10ATEX27043X, and Class I, Zone 1 AEx ib IIB T4 Gb and Class I, Zone 1 Ex ib IIB T4 Gb
Operating temperature	–10 to 50 °C (14 to 122 °F)
Storage temperature	–40 to 60 °C (–40 to 140 °F)
Altitude	4000 m (13,123 ft) maximum

2.1 Safety information

Please read this entire manual before unpacking, setting up, or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To ensure that the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that specified in this manual.

2.1.1 Use of hazard information



DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

DANGER

Indique une situation de danger potentiel ou imminent qui, si elle n'est pas évitée, peut entraîner la mort ou des blessures graves.



WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

AVERTISSEMENT

Indique une situation de danger potentiel ou imminent qui, si elle n'est pas évitée, pourrait entraîner la mort ou des blessures graves.



CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

ATTENTION

Indique une situation potentiellement dangereuse qui peut entraîner des blessures mineures ou modérées.

Important Note: *Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.*

Remarque importante: *Indique une situation qui, si elle n'est pas évitée, peut provoquer des dommages à l'appareil. Informations nécessitant une insistance particulière.*

Note: *Information that supplements points in the main text.*

Remarque : *Informations complétant des points du texte principal.*

2.1.2 Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed.



This is the safety alert symbol. Obey all safety messages that follow this symbol to avoid potential injury. If on the instrument, refer to the instruction manual for operation or safety information.

Ceci est le symbole d'alerte de sécurité. Se conformer à tous les messages de sécurité qui suivent ce symbole afin d'éviter des blessures potentielles. Si apposés sur l'instrument, se référer au manuel d'utilisation pour le fonctionnement ou les informations de sécurité.

General information

	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of life equipment to the Producer for disposal at no charge to the user. Note: For return for recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment, producer-supplied electrical accessories, and all auxiliary items for proper disposal. L'équipement électrique marqué de ce symbole ne devra pas être détruit dans les systèmes de destruction publics Européens après le 12 août 2005. En conformité avec les dispositions européennes locales et nationales (Directive EU 2002/96/EC), les utilisateurs européens d'équipements électriques doivent maintenant renvoyer au fabricant pour destruction les équipements anciens ou en fin de vie, sans frais pour l'utilisateur. Remarque : Pour le retour à des fins de recyclage, veuillez contacter le fabricant ou le fournisseur d'équipement pour obtenir les instructions sur la façon de renvoyer l'équipement usagé, les accessoires électriques fournis par le fabricant, et tous les articles auxiliaires pour une mise au rebut appropriée.
	This symbol, when noted on a product enclosure or barrier, indicates that a risk of electrical shock and/or electrocution exists. Si ce symbole se trouve sur l'instrument, il indique la présence d'un danger de choc électrique ou d'électrocution.
	This symbol, when noted on the product, identifies the location of the connection for Protective Earth (ground). Ce symbole, lorsqu'il est apposé sur le produit, indique l'emplacement de la connexion de mise à la terre.
	This symbol, when noted on the product, identifies the location of a fuse or current limiting device. Lorsque ce symbole se trouve sur un produit, il indique l'emplacement d'un fusible ou autre protection contre les surcharges.
	This symbol, when noted on the product, indicated the presence of devices sensitive to Electro-static Discharge (ESD) and indicated that care must be taken to prevent damage with the equipment. Ce symbole, s'il figure sur le produit, indique la présence des dispositifs sensibles à la décharge électrostatique (ESD) et la nécessité d'agir avec précaution pour éviter d'endommager l'équipement.

2.1.3 Confined space precautions



DANGER

Explosion hazard. Training in pre-entry testing, ventilation, entry procedures, evacuation/rescue procedures and safety work practices is necessary before entering confined spaces.

DANGER

Danger d'explosion. Une formation incluant des tests de pré-entrée, la ventilation, les procédures d'entrée, les procédures d'évacuation/de sauvetage et des pratiques de travail de sécurité est nécessaire avant d'entrer dans des espaces restreint.

Important Note: The following information is provided to guide users of Flo-Dar Sensors on the dangers and risks associated with entry into confined spaces.

Remarque importante : Les informations suivantes sont fournies dans le but d'informer les utilisateurs des capteurs Flo-Dar des dangers et des risques associés à l'accès aux espaces confinés.

On April 15, 1993, OSHA's final ruling on CFR 1910.146, Permit Required Confined Spaces, became law. This new standard directly affects more than 250,000 industrial sites in the U.S.A., and was created to protect the health and safety of workers in confined spaces.

Definition of a confined space:

A confined space is any location or enclosure that presents or has the immediate potential to present one or more of the following conditions:

- An atmosphere with less than 19.5% or greater than 23.5% oxygen and/or more than 10 ppm Hydrogen Sulfide (H₂S).
- An atmosphere that may be flammable or explosive due to gases, vapors, mists, dusts or fibers.
- Toxic materials which upon contact or inhalation, could result in injury, impairment of health or death.

Confined spaces are not designed for human occupancy. They have restricted entry and contain known or potential hazards. Examples of confined spaces include manholes, stacks, pipes, vats, switch vaults, and other similar locations.

Standard safety procedures must always be followed prior to entry into confined spaces and/or locations where hazardous gases, vapors, mists, dusts or fibers may be present. Before entering any confined space check with your employer for procedures related to confined space entry.

2.2 Product overview

The Flo-Dar Intrinsically Safe Sensor measures the flow velocity and liquid depth in open channels using radar and ultrasonic technology. The unit is designed to withstand submersion during surcharge conditions. The optional surcharge velocity sensor provides velocity measurements during surcharge conditions.

Figure 1 shows the configuration of a Flo-Dar system in a hazardous location installation.

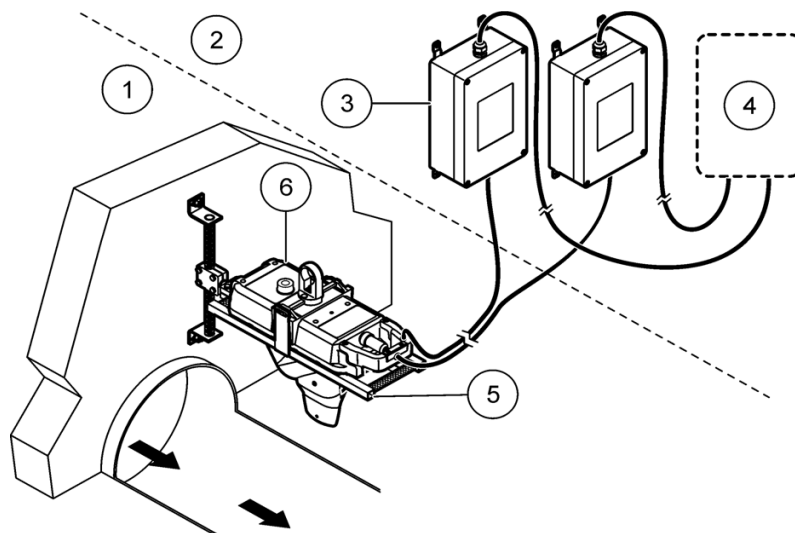


Figure 1 System overview

1	Hazardous environment	4	Logger or controller
2	Non-hazardous environment	5	Mounting frame
3	Intrinsically safe barrier	6	Flo-Dar sensor with optional surcharge velocity sensor



DANGER

Explosion hazard. Trained personnel only must install or commission the equipment.

DANGER

Danger d'explosion. Seul le personnel formé est autorisé à installer ou à mettre en service l'équipement.

This chapter includes only the installation information for hazardous location use. For the installation, operation, and replacement part and accessory information for non-hazardous location use, refer to the *Flo-Dar Sensor User Manual*.

3.1 Precautions for hazardous location installations



DANGER

Explosion hazard. To ensure safety, the installation of instruments in hazardous locations must follow the specifications in the control drawings. Any modification to the instrumentation or to the installation may result in life threatening injury and/or damage to facilities.

DANGER

Danger d'explosion. Pour assurer la sécurité, l'installation des instruments dans des emplacements dangereux doivent suivre les spécifications dans l'emplacement dangereux indiqué sur la fiche technique. Toute modification de l'appareil ou de l'installation peut conduire à des préjudices constituant un danger de mort et/ou des dégâts sur les installations.

The Flo-Dar Intrinsically Safe Sensor is listed as intrinsically safe for Class 1, Zone 1, Group IIB Hazardous Locations. This means that the circuits within these sensors cannot produce a spark or thermal effect that could ignite a mixture of flammable or combustible gases when installed properly. It does not mean that these sensors are explosion proof. If proper safety precautions are not followed, or if the equipment is not installed properly, there is a serious potential for explosion. Be sure to review all safety precautions, installation and wiring practices throughout this manual before installing the Flo-Dar Intrinsically Safe Sensor.

3.1.1 Intrinsically safe installation requirements

Installation of this equipment must satisfy local electrical code requirements using the hazardous location control drawings and is subject to final approval by the authority having jurisdiction. Install all associated apparatus, such as the intrinsically-safe barrier, logger or controller in a non-hazardous location.

3.1.2 Hazardous location control drawings



DANGER

Explosion hazard. Never connect items to the sensor that are not specified on the control drawings. Do not connect or disconnect any equipment unless power has been switched off or the area is known to be non-hazardous.

DANGER

Danger d'explosion. Ne branchez jamais au transmetteur des éléments ne figurant pas sur la fiche technique. Ne branchez et ne débranchez aucun équipement sans avoir préalablement coupé l'alimentation et vous être assuré que l'environnement ne présentait aucun danger.

Follow the control drawings provided ([section 3.4 on page 15](#)) and all codes and regulations for connection to the sensor in the hazardous location.

3.2 Sensor installation



WARNING

Explosion hazard. Installation of equipment into hazardous locations must be done so that no friction can be generated between the Flow Meter and any surrounding surfaces.

AVERTISSEMENT

Risque d'explosion. L'installation de l'équipement dans des zones dangereuses doit être effectuée de sorte qu'aucun frottement ne soit provoqué entre le débitmètre et toute surface environnante.

Mount the Flo-Dar sensor above the open channel on the wall of the manhole. For hazardous locations, a barrier must be installed outside of the hazardous area.

To prevent damage to the enclosure, do not mount the Flo-Dar sensor in a location that receives direct sunlight.

3.2.1 Install the frame on the wall



DANGER

Explosion hazard. Review the safety information in [section 2.1 on page 5](#) and [section 3.1 on page 9](#) before entering a confined space.

DANGER

Danger d'explosion. Revoyez les information concernant la sécurité dans [section 2.1 on page 5](#) et [section 3.1 on page 9](#) avant d'entrer dans une espace restreint.

3.3 Electrical installation

3.3.1 Wiring safety information



CAUTION

Always disconnect power to the instrument when making any electrical connections.

ATTENTION

Débranchez toujours l'alimentation de l'appareil avant toute connexion électrique.



WARNING

Explosion hazard. Voltage connections to the barrier must be from 12 VDC powered loggers. Power can be supplied from a battery or 12 VDC SELV source which has 3rd party NRTL certifications for Canada and the U.S.A., and the correct CE marking and Declaration of Conformity for Europe.

AVERTISSEMENT

Risque d'explosion. La connections électrique sur le système de barrière de sécurité est seulement possible avec des appareils alimentés en 12VDC. L'alimentation peut venir d'une batterie ou d'une source 12VDC séparée ou très basse tension sécurisée (SELV) qui possède la 3ème partie de certifications NRTL pour le CANADA et USA, et le marquage CE et déclaration de conformité pour l'Europe.

3.3.2 Electrical installation in a hazardous location

A barrier with appropriate entity parameters must be installed between the sensor and the logger or controller for installation in hazardous locations. If the SVS option is used, an additional barrier with appropriate entity parameters must also be installed between the SVS component and the logger or controller.

3.3.2.1 Install the barrier

A barrier must be installed when the Flo-Dar sensor is installed in a hazardous location as defined in [section 3.1 on page 9](#). A barrier limits the power parameters to the device that is located in the hazardous area. The barrier and the logger or controller must always be installed in a non-hazardous location.

The barrier has a dielectric strength of 500 Vrms between the intrinsically safe outputs and the frame of the apparatus. Separation between the intrinsically safe outputs and connections to non-intrinsically safe devices and separation between separate intrinsically safe output channels (power, RS485A and RS485B) should be maintained in accordance with the installation instructions and markings since there is no galvanic isolation between these circuits.

Procedure

1. Install the barrier on a wall in a non-hazardous environment ([Figure 2 on page 12](#)).
2. Follow the control drawings provided ([section 3.4 on page 15](#)) and all codes and regulations for connection to the sensor in the hazardous location.

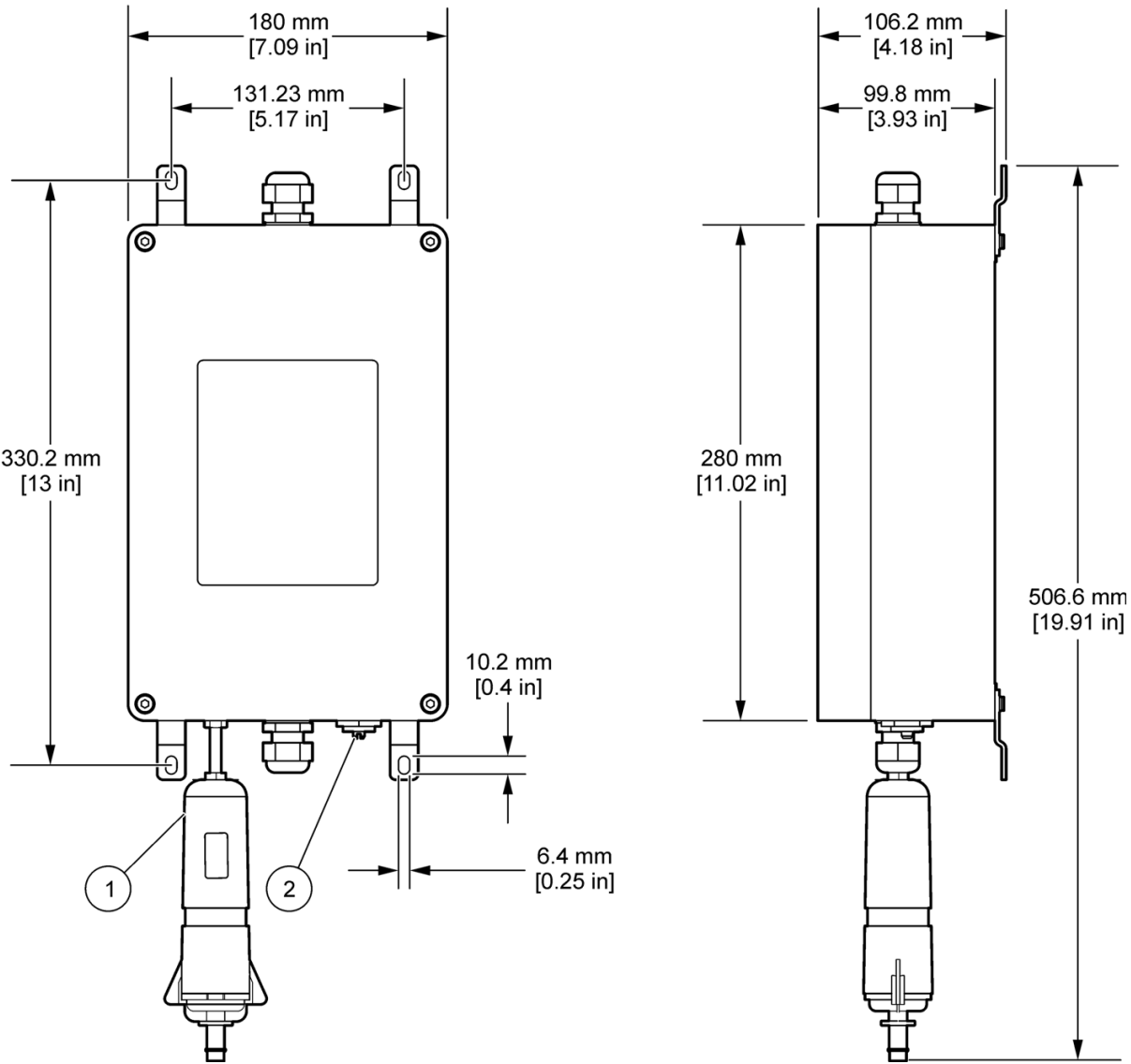


Figure 2 Barrier dimensions

1	Desiccant	2	Connector for protective earth ground (PEG)
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3.3.2.2 Wiring to the barrier

Use the supplied cables for electrical wiring to the barrier. Make sure to install a protective earth ground to the barrier.

Procedure

1. Remove the four screws from the cover of the barrier. Remove the cover.
2. Insert the cable from the Flo-Dar sensor through the strain relief fitting on the side of the barrier with the hazardous area connection label ([Figure 3 on page 14](#)). Tighten the strain relief.
3. If the Flo-Dar sensor has the optional SVS component, insert the cable from the SVS sensor through the strain relief fitting on the side of the second barrier with the hazardous area connection label ([Figure 3 on page 14](#)). Tighten the strain relief.
4. Prepare each wire.
5. Install the wires in terminals J3 and J4 as shown in [Figure 3 on page 14](#). Pull lightly after each insertion to make sure the connections are tight.
6. Insert the cable from the logger or controller through the strain relief fitting on the other side of the barrier ([Figure 3 on page 14](#)). Tighten the strain relief.
7. Prepare each wire.
8. Install the wires in terminals J1 and J2 as shown in [Figure 3 on page 14](#). Pull lightly after each insertion to make sure the connections are tight.
9. Replace the cover on the barrier and install the screws.
10. Connect a protective earth ground (PEG) to the ground stud on the barrier ([Figure 2 on page 12](#)) where local code or authorities permit or require such a connection. If required, use a copper wire that is AWG 9 or larger.

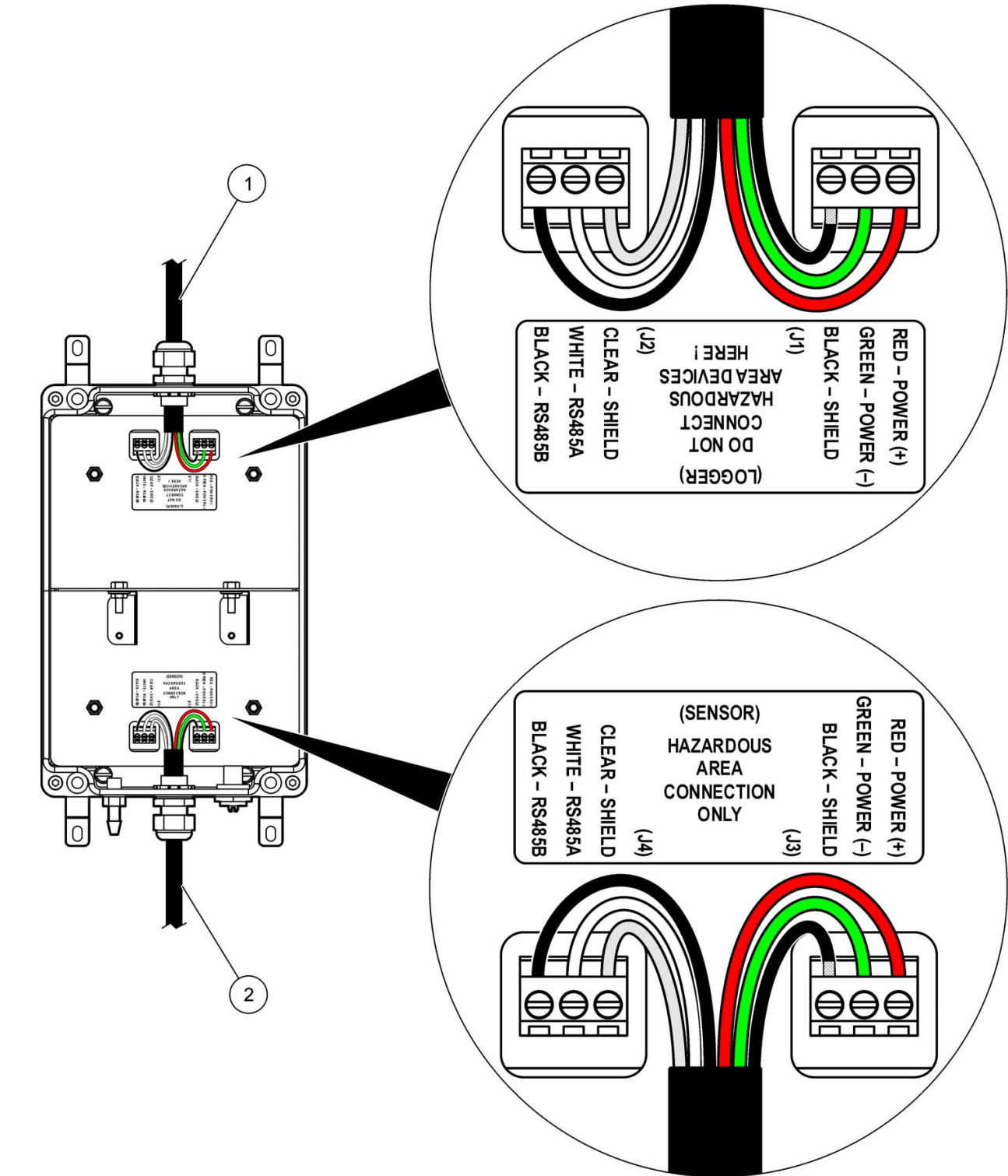


Figure 3 Barrier wiring

1	Cable to logger or controller	2	Cable from Flo-Dar or SVS sensor
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3.3.2.3 Connection to the logger or controller

Important Note: The length of the cable between the barrier and the logger or controller cannot be longer than 750 feet.

Remarque importante : La longueur du câble entre la plaque et l'enregistreur ou le transmetteur ne doit pas dépasser les 229 mètres.

Connect the cable from the barrier to the logger or the controller:

- **Logger**—connect the cable from the barrier to the connector on the logger. Make sure that the barrier that is connected to the Flo-Dar sensor is connected to the Flo-Dar connector on the logger. Make sure that the barrier that is connected to the optional SVS sensor is connected to the SVS connector on the logger.
- **Controller**—connect the cable from the barrier to the controller. For wire terminal connections to the controller, refer to the user manual for the controller. Make sure that the barrier that is connected to the Flo-Dar sensor is connected to the Flo-Dar terminal in the controller. Make sure that the barrier that is connected to the optional SVS sensor is connected to the SVS terminal in the controller.

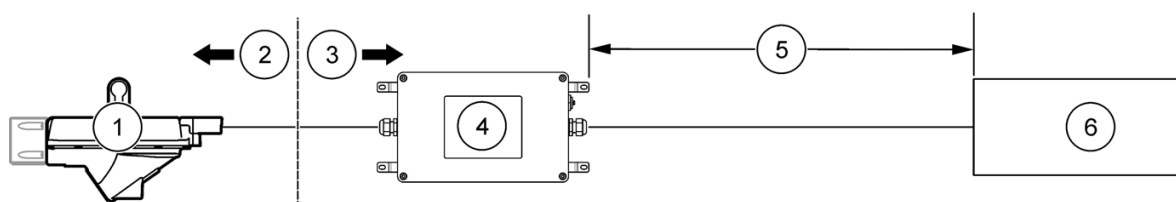


Figure 4 Typical intrinsically safe configuration

1 Flo-Dar sensor	4 Barrier
2 Intrinsically-safe environment	5 750 ft maximum cable length between barrier and logger or controller
3 Non-intrinsically-safe environment	6 Logger or controller

3.4 Approved Flo-Dar installation drawings



DANGER

Any installation or flow meter configuration that is not specifically detailed on the following control drawings is not allowed. In all cases, the local authority having jurisdiction shall have the final say.

DANGER

Il est interdit de procéder à toute installation ou configuration d'un débitmètre qui n'est pas explicitement détaillée dans les schémas de contrôle de l'installation ci-dessous. Dans tous les cas, c'est l'autorité locale responsable qui aura le dernier mot.

Figure 5 on page 16, Figure 6 on page 17 and Figure 7 on page 18 are approved control drawings. These certified drawings explain the ONLY approved method of installing the Flo-Dar sensor. Additionally, these drawings list both part number, description, and the only certified sensors, probes, and associated equipment to be used with this sensor. Any substitutions will automatically void the Intrinsically Safe certification of the flow meter and could result in fire or explosion.

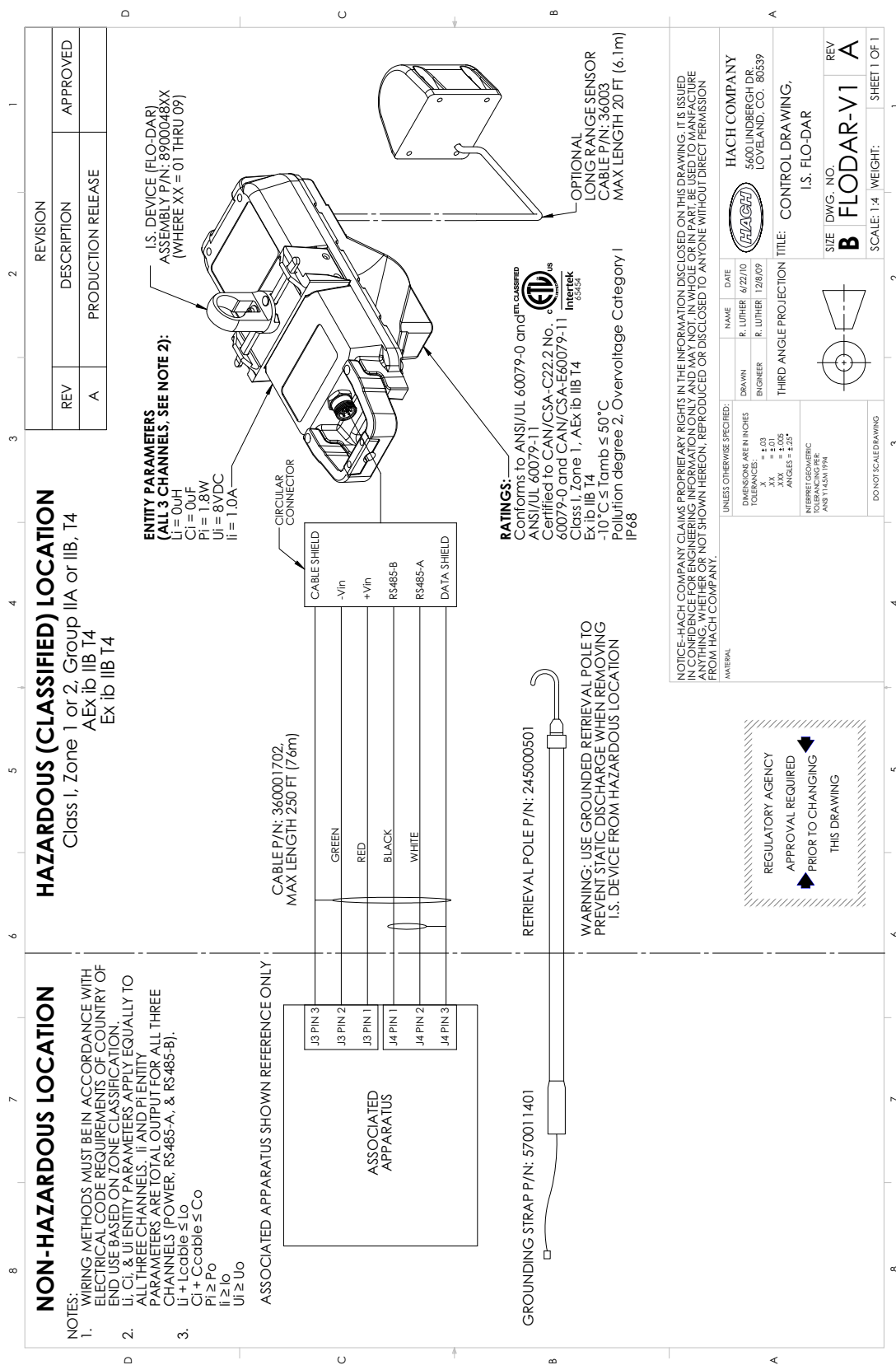


Figure 5 Installation Control Drawing 1

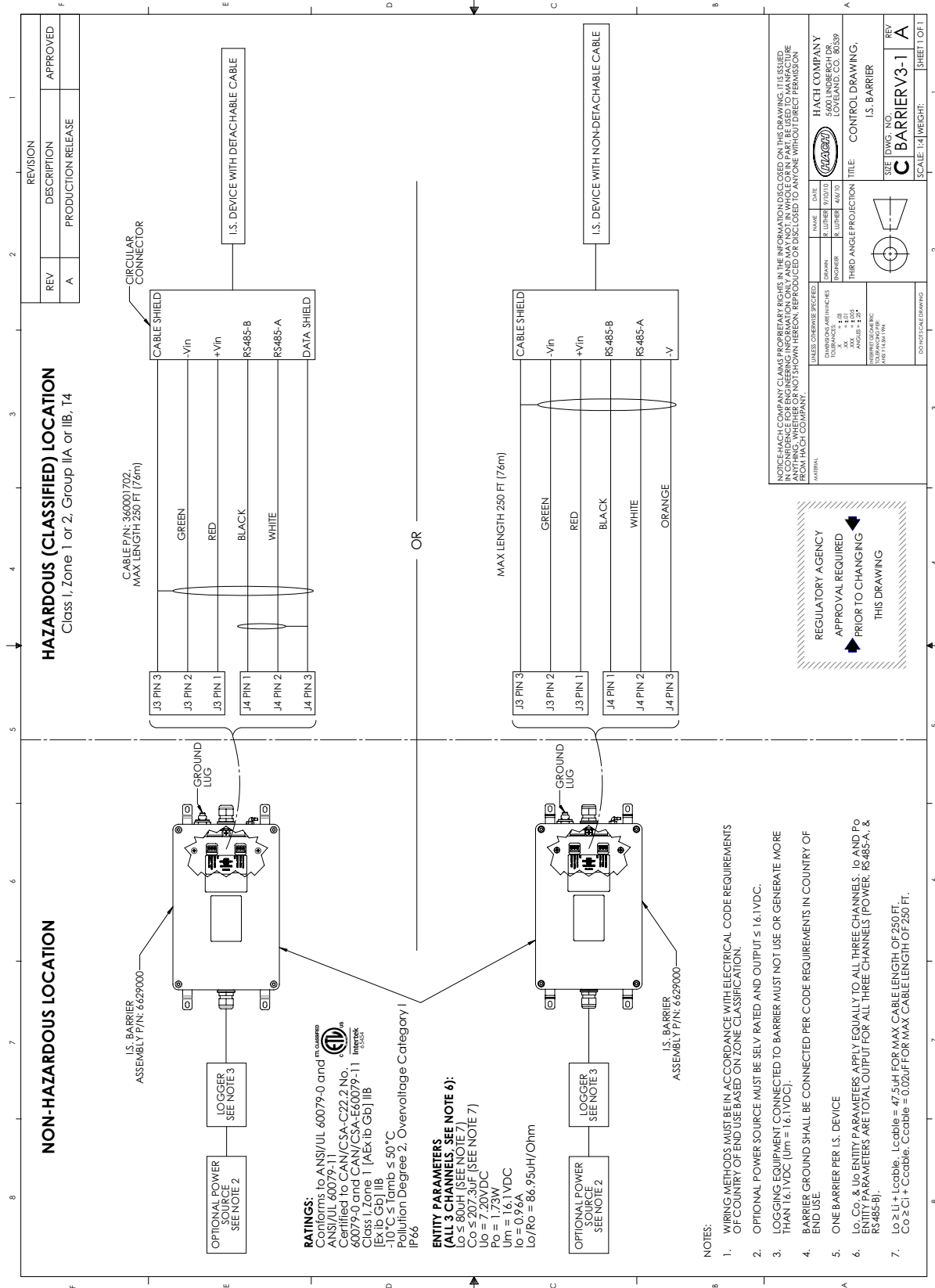


Figure 6 Installation Control Drawing 2

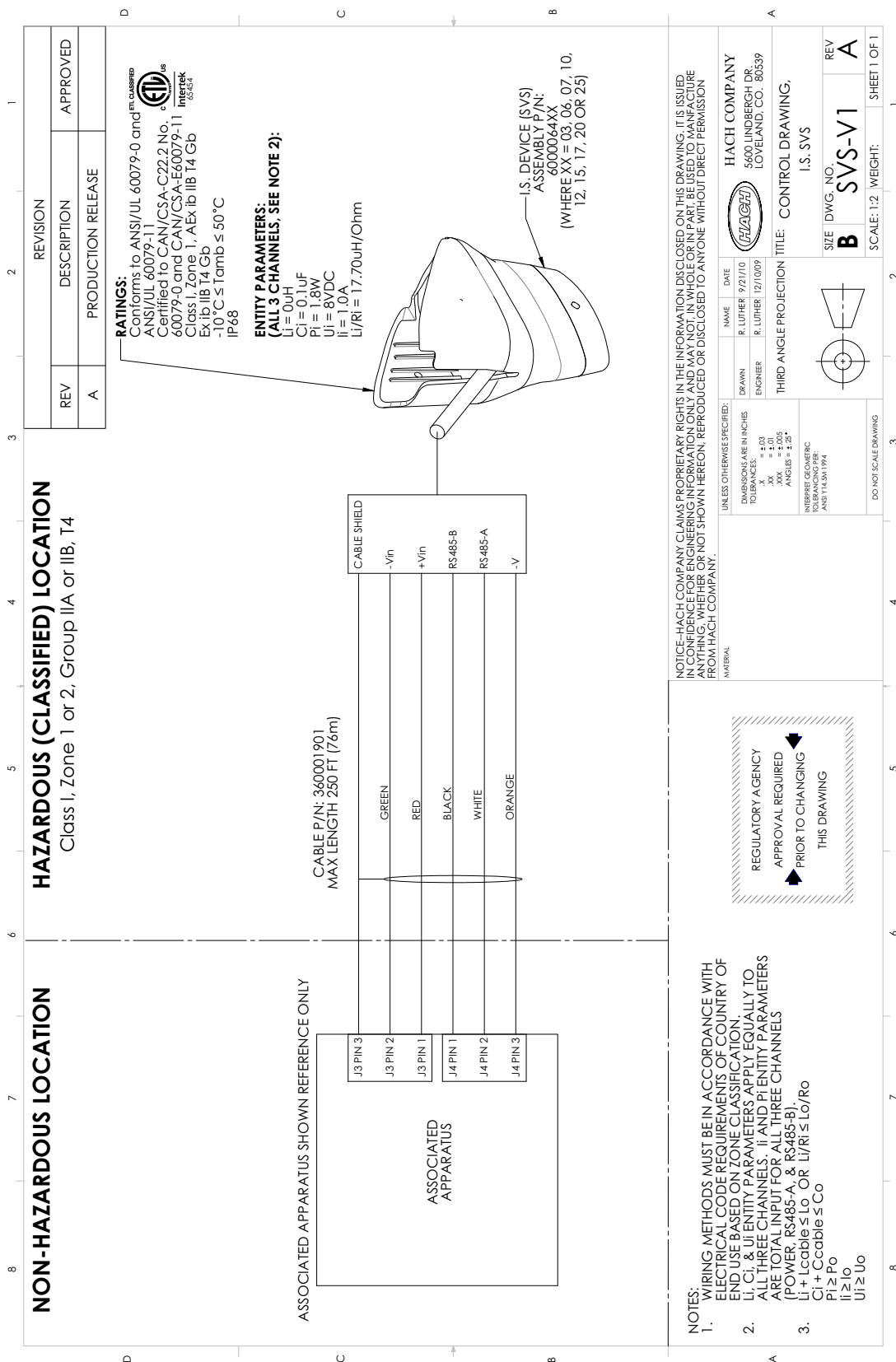


Figure 7 Installation Control Drawing 3



DANGER

Explosion hazard. Only qualified personnel should conduct the tasks described in this section of the manual.

DANGER

Danger d'explosion. Les opérations décrites dans cette section du manuel ne doivent être effectuées que par du personnel qualifié.



DANGER

Explosion hazard. When using the retrieval pole, make sure to connect the grounding strap to the ground lug on the barrier. The sensor must also be connected to the barrier during maintenance activities. This is to prevent ignition of explosive gases due to static discharge.

DANGER

Danger d'explosion. Lors de l'utilisation du pôle de récupération, assurez-vous de connecter la languette de mise à la masse à la cosse de masse de la plaque. Le capteur doit également être connecté à la plaque pendant les opérations de maintenance. Ceci sert à éviter d'enflammer les gaz explosifs dus à la décharge statique.

The safety provided by the barrier may be impaired if any of the following conditions have occurred:

- *visible damage*
- *storage above 70 °C for prolonged periods*
- *exposure to severe transport stresses*
- *previous installation*
- *failure to operate properly*

If any of these conditions have occurred, return the device to the manufacturer for recertification.



WARNING

Explosion hazard. To prevent ignition of explosive atmospheres, disconnect power before servicing.

AVERTISSEMENT

Risque d'explosion. Pour éviter tout risque de déflagration, mettez l'appareil hors tension avant toute intervention d'entretien.

This chapter includes only the maintenance information for hazardous location use. For the maintenance information for non-hazardous location use, refer to the *Flo-Dar Sensor User Manual*.

The Flo-Dar sensor contains no user serviceable or repairable components. If service is necessary, the Flo-Dar sensor must be sent to an authorized service center for repair or servicing.

4.1 Cleaning the instrument



DANGER

Explosion hazard. Never attempt to wipe or clean the Flo-Dar or SVS sensor while in a hazardous location. Do not use abrasives or high-pressure hoses or washers to clean the sensors. Do not disturb the pressure port on the bottom of the sensor.

DANGER

Danger d'explosion. N'essayez jamais d'essuyer ou de nettoyer le Flo-Dar ou le capteur SVS dans un emplacement dangereux. N'utilisez pas de produits abrasifs ou de tuyaux sous pression ou d'appareils de nettoyage pour nettoyer les capteurs. Ne dérangez pas le port sous pression situé dans le bas du capteur.

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